

## Cancer mortality in Europe in 2015, and an overview of trends since 1990

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**Short title:** Cancer mortality in Europe

**Key message:** Mortality rates from most neoplasms continued to decline in Europe over the 2000s by over 1% per year in men and about 0.8% in women, with the only exception of pancreatic, skin and kidney cancers, and lung cancer in women. However, there were substantial differences across Europe, with generally less favourable trends in most eastern European countries.

## Abstract

### Background

Cancer mortality in Europe has been decreasing since the late 1980s or 1990s though with different patterns in many areas. In this work, we updated trends in cancer mortality in Europe.

### Methods

We extracted data from the World Health Organization mortality database for 24 cancer sites, 36 European countries and the European Union (EU) as a whole over the 1990-2017 period. We computed age-standardized death rates per 100,000 population and we performed a joinpoint regression analysis for all cancers, selected major neoplasms and countries. The estimated annual percent change (APC) for each identified linear segment, and the weighted average APC (AAPC) over the entire study period were provided as summary measures of the changes in rates over the time period.

### Results

In 2015, the age-standardized mortality rates from all cancers in the EU were 137.5 deaths per 100,000 in men and 85.7 in women. Eastern European countries showed the highest rates with values over 150 deaths per 100,000 in men and over 100 deaths per 100,000 in women. Mortality from all cancers in the EU declined annually by 1.5% in men since 2006 and by 0.8% in women since 2007. Most cancer sites showed decreasing trends with steady declines over the whole period for cancers of stomach, intestines, lung in men, breast and prostate. Unfavourable mortality trends persisted for cancers of liver, lung in women, pancreas, besides skin and kidney.

### Conclusions

The downward trends in total cancer mortality in Europe still continue over the last decade. However, the trends were less favourable in most eastern European countries. Tobacco control in men (but not in women), improvements in diagnosis and therapy were the underlying factors of these trends.

**Keywords:** cancer, mortality, Europe, trends

## Introduction

Cancer mortality shows substantial variation across Europe. Steady declines were observed since the 1980s in most western European countries, and a decade later in central and eastern Europe [1]. Such favourable trends have been attributed to the reduced prevalence of smoking in men [2, 3] and decreased alcohol consumption in Mediterranean countries [4], but also to the increased availability of screening, early diagnosis, and treatment. However, suboptimal tobacco control, inadequate adoption of modern diagnostic techniques and effective treatment have produced remarkable disparities in cancer mortality across Europe [5] with systematically less favourable mortality trends in eastern European countries [1, 6].

In this work, we provide updated data on cancer mortality in Europe.

## Materials and Methods

We extracted official death certification data from the World Health Organization (WHO) database for 24 cancer sites plus all neoplasms in 36 European countries plus the European Union 28 Member States (EU-28) as a whole, for the 1990-2017 period [7]. All countries considered had death certification coverage over 95%, except Serbia (84%). During the considered calendar years, we used three different Revisions of International Classification of Diseases (ICD) and coded cancer deaths for all calendar years and countries, according to the 10<sup>th</sup> Revision of the ICD [8].

We obtained estimates of the resident population, based on official censuses, from the same WHO database [7]. Since population estimates for France and Ireland in 2015, Spain in 2016, and Switzerland in 2014 and 2015 were not available in the WHO database, these were obtained from the EUROSTAT database [9]. No interpolations were made for missing data in a few countries and calendar years, except for the calculation of the rates for the EU-28 as a whole.

Using the dataset with deaths counts and resident populations, we calculated age-specific rates for 18 age groups (from 0-4 to 80-84, and ≥85 years), sex and calendar year. We then computed age-standardized mortality rates per 100,000 person-years (at all ages and the 35-64 age-group), based on the world standard population [10].

For the EU-28 as a whole and a subset of 24 selected major countries (i.e. with populations over 5 million inhabitants), we performed a joinpoint regression analysis on mortality data for all neoplasms, and selected

major cancers (i.e. intestines, lung, breast and prostate), over the 1990–2017 period [11]. We thus identified the time point(s), called “joinpoints”, when a change in the linear slope (on a log scale) of the temporal trend occurred [12], by testing from a zero up to a maximum of four joinpoints. The estimated annual percent change (APC) for each identified linear segment, and the weighted average APC (AAPC) over the entire study period (1990–2017) as a summary measure, were computed for each joinpoint model [12, 13].

## Results

Table 1 and Table 2 give the overall age-standardized mortality rates per 100,000 men and women, respectively, and number of deaths from selected cancers observed in 2015 in 36 European countries and the EU-28 as a whole. Figures S1–S8 show rates (from largest to smallest) for the EU-28 by cancer site (Figure S1), and for all neoplasms (S2) and selected major cancers (S3–S8) by country (Online-only Supplementary Material).

In men, all neoplasms mortality rate in the EU-28 was 137.5/100,000 corresponding to 760,123 deaths in 2015. Most eastern European countries and Russia showed the highest mortality rates, while northern European countries had the lowest ones. With regard to major cancers, in the EU-28, male mortality rates were 34.8/100,000 for lung cancer, 16.1 for intestinal cancer, 10.7 for prostate cancer, 7.9 for pancreatic cancer, and 6.3 for stomach cancer. Mortality rates from male lung cancer ranged between 15–23/100,000 in Scandinavian countries, 27–36 in the UK, France, Germany, Italy and Spain, to 45–63 in eastern European countries and Russia. Mortality rates from intestinal cancer ranged from about 13–15/100,000 in major western countries, to around 30/100,000 in Hungary, Slovakia and Croatia. The Russian rate was 18.7/100,000. Mortality from prostate cancer showed the highest rates in Baltic and Scandinavian countries, while the lowest ones were in Italy and other southern European countries. Mortality from pancreatic cancer ranged between 6.5 and 8.5/100,000 in the UK, Spain, Italy, France, and Germany, to around 10–11/100,000 in several central and eastern European countries. Stomach cancer mortality rates ranged from 3–4 deaths/100,000 in northern and central European countries, to 19.4/100,000 in Russia, followed by other eastern European countries. Portugal, Italy, and Spain had relatively high rates, too.

In women, total cancer mortality rate in the EU-28 was 85.7/100,000, corresponding to 603,984 deaths in 2015. The highest mortality rate was observed in Hungary, followed by other eastern and northern countries.

In contrast, the lowest mortality rates were observed in southern and eastern countries, with the lowest one in Spain. With regard to major cancers, EU-28 female mortality rates were 14.5/100,000 for breast cancer, 14.3 for lung cancer, 9.4 for intestinal cancer, 5.5 for pancreatic cancer, and 2.9 for stomach cancer. The highest breast cancer rates were in Serbia and other central European countries (around 14-15), and Russia (15.7), while the lowest ones were in Norway, other Scandinavian countries, and Spain (about 10-11/100,000). The highest lung cancer rates were in Hungary, followed by some northern countries, while the lowest ones were in eastern Europe. Mortality rates from intestinal cancer ranged between 7-8 deaths/100,000 in Austria, Greece, Switzerland, and France, to 15.1/100,000 in Hungary. Mortality from pancreatic cancer ranged from 3.6/100,000 in Ukraine, around 4 in Portugal and Spain, to 7.3 deaths/100,000 in Hungary. Mortality from stomach cancer ranged from 1.5/100,000 in France, followed by most western and northern European countries (rates around 2), to 7.9/100,000 in Russia.

Corresponding figures for the 35-64 age group are displayed in the Tables S1 and S2 (Online-only Supplementary Material).

Figure 1 and Table S3 show the joinpoint regression analysis of mortality trends for 23 cancer sites plus all neoplasms in the EU-28 from 1990 to 2015 at all ages and for the 35-64 age group, in men and women. The downward trends in total cancer mortality started in the early 1990s and the mortality rate at all ages declined annually by 1.5% in men since 2006 and by 0.8% in women since 2007. Downward trends were observed for most cancer sites, with steady declines for cancers of stomach, intestines, lung in men, breast and prostate. In contrast, unfavourable trends were observed for lung cancer in women and increasing or stable rates were observed for pancreatic cancer. Favourable trends were also observed for most other cancer sites, except liver over the recent calendar years, skin and kidney in men.

Figures 2a-2e (and Tables S4a-S4e) give the results from the joinpoint analysis of mortality trends (1990-2017) for all neoplasms and major cancer sites in 24 selected countries. Mortality from all neoplasms declined in most countries for both sexes, with the exceptions of Bulgaria, Greece and Romania. The favourable trends started after the mid-1990s in most eastern countries, Norway and Spain. Upward trends were observed in mortality rates from intestinal cancer in East Europe. Lung cancer mortality decreased in most countries in men, except in Bulgaria, Portugal and Romania. Lung cancer mortality in women increased in most countries, while breast cancer decreased by 2-4% per year over the most recent period in most

northern European countries, and around 1.5% in most western and southern countries. In Russia, breast cancer mortality started to decline over the last few years. Greater declines in breast cancer were observed among middle-aged women. After the increasing trends observed over the 1990s, mortality from prostate cancer declined in most countries with a few exceptions in East Europe.

## Discussion

Mortality rates from major cancer sites continued to decline in the EU-28 over the 2000s, with the only exception of pancreatic, skin and kidney (only in men) cancers and of some increase in mortality from liver cancer in both sexes and lung cancer in women. However, there are substantial differences among EU countries, with less favourable trends taking place in some eastern European countries.

The downward trends in overall cancer mortality is mainly driven by the declines in mortality from most tobacco-related cancers in men consequent to the reduction in male smoking prevalence across Europe [2, 3].

The opposite trend in female lung cancer mortality reflects the different stage in the smoking epidemic between sexes, and the lagged decline in smoking prevalence in women compared to men [2, 14, 15].

The potential impact of tobacco reduction in men on mortality from pancreatic cancer was partly counterbalanced by the rising prevalence of obesity and diabetes over the last three decades [16]. Moreover, improved diagnosis and certifications may have played some role on the unfavorable mortality trend from pancreatic cancer.

Apart from the smoking prevalence reduction in men, the steady decline in stomach cancer mortality could also be attributed to improved water sanitation, lifestyle and environmental conditions that resulted in reduced prevalence of *Helicobacter pylori* infection [17]. The reduced consumption of food preserved by salting, pickling and smoking may have also contributed to the downward trend [18].

Improved working conditions and less exposure to occupational carcinogens [19, 20] have also contributed to the downward trends in mortality from lung and bladder cancer.

Reductions in alcohol consumption, especially in southern Europe, partly explains the decline in cancer of oral cavity, pharynx and esophagus [4]. On the other hand, increased harmful alcohol consumption in

northern Europe and increased prevalence of HCV in northern and eastern Europe [4] have driven the increment in primary liver cancer mortality all over Europe [21, 22].

Screening and early diagnosis have contributed to the reduction in mortality from colorectal cancer [23, 24]. However, the screening uptake differs among countries due to resource availability that may explain some of the between-country variability in mortality patterns and trends [25, 26].

Mammography screening programs, early diagnosis and mostly availability of effective therapy, including progress in radiotherapy and surgery are the key factors for the substantial downward trends in breast cancer mortality in Europe [27, 28], as in other (high-income) areas of the world [29]. Some eastern countries, including Romania, Russia and Ukraine showed less favorable trends. Breast cancer rates in those areas of the continent were particularly low in the past [30], and this may reflect some levelling of rates across Europe. In addition, delays in the adoption of effective screening programs and treatments are possible in those countries [6].

Wider adoption of radical prostatectomy in combination with adjuvant hormonal therapy for localized cancers may partly explain the downward trend in prostate cancer mortality observed since the late 1990s in Europe, though the role of PSA testing is likely, but still unquantified [31].

The decline in mortality from cancer of the testis observed since 1970s continued over the 1990s, but levelled off during the 2000s. This pattern has been mainly attributed to the adoption of effective treatments, mainly platinum-derived chemotherapy and its analogues [32].

Subsequent advancements in therapies were the key underlying factors of the downward trend in mortality from leukaemias, targeted therapy has improved the prognosis of patients with chronic myelogenous leukemia and allogeneic hematopoietic cell transplantation improved survival in all malignant hematologic diseases [33-36].

The less favorable trend in mortality from skin cancer may reflect the increased recreational exposure to sunlight ultraviolet radiation and use of tanning beds [37], while the growing obesity [16] and hypertension rates are possible explanation of the increased mortality due to kidney cancer [38].

Despite possible problems in data quality, death certification is reasonably valid in all the European countries considered, and allows therefore to obtain a meaningful time trends analysis for most countries considered [39, 40].

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## Figures' Legend

**Figure 1.** Joinpoint analysis of trends in age-standardized (world population) mortality rates from 23 cancer sites and all neoplasms (malignant and benign) in the European Union, from 1990 to 2015. Filled boxes represent men, all ages; empty boxes men, 35-64 age group; filled circles women, all ages; empty circles women, 35-64 age group.

**Figure 2.** Joinpoint analysis of trends in age-standardized (world population) mortality rates from all neoplasms (a), cancers of intestines (b), lung (c), breast (d) and prostate (e), in 24 selected European countries, from 1990 to 2017 (according to data availability). Filled boxes represent men, all ages; empty boxes men, 35-64 age group; filled circles women, all ages; empty circles women, 35-64 age group.

**Table 1.** Overall age-standardized (world population) mortality rates (first row) and average annual number of deaths (second row) from selected cancers per 100,000 men in 36 European countries plus the European Union as a whole (EU-28) in 2015<sup>a</sup>.

	Oral cavity/ Pharynx	Esophagus	Stomach	Intestines	Liver	Gallbladder	Pancreas	Larynx	Lung	Bone	Connective/soft tissue sarcomas	Skin	Prostate	Testis	Bladder	Kidney	Thyroid	HL	NHL	MM	Leukemias	All neoplasms
ICD-10	C00-C14	C15	C16	C17-C21, C26	C22.0- C22.7	C23-C24	C25	C32	C33- C34	C40- C41	C47,C49	C43- C44	C61	C62	C67	C64- C66,C68	C73	C81	C82- C85,C 96	C88,C 90	C91-C95	C00-D48
Austria	4.71 372	3.21 267	4.94 462	12.76 1238	6.17 556	0.88 83	9.29 866	1.26 112	27.60 2396	0.46 27	0.99 78	3.08 306	9.77 1128	0.24 14	3.87 381	4.23 405	0.30 28	0.11 13	3.31 315	2.01 195	3.72 358	121.38 1124.80
Belarus	11.18 706	5.50 351	17.55 1124	16.73 1089	3.36 213	- -	8.06 510	4.43 282	39.97 2550	- -	- -	1.81 110	12.10 799	- 261	- -	- -	- -	- -	3.04 179	1.26 79	4.88 288	160.46 1015.88
Belgium	4.13 424	5.09 554	3.92 472	13.91 1790	4.36 482	0.56 71	6.93 815	1.40 155	36.76 4338	0.62 54	0.83 88	1.97 238	9.74 1532	0.13 11	4.71 673	3.96 513	0.24 29	0.26 33	3.26 418	1.89 269	4.00 511	128.60 1587.83
Bulgaria	5.31 327	2.23 146	9.88 718	20.18 1542	3.28 226	0.81 60	8.70 624	5.68 378	40.81 2746	1.35 61	0.53 24	2.47 172	10.71 949	0.89 44	5.79 453	4.18 283	0.31 21	0.50 29	2.73 166	0.88 60	4.05 255	151.20 1058.40
Croatia	7.40 274	3.56 140	10.81 478	28.13 1247	4.61 195	2.19 102	8.44 363	4.54 185	51.03 2101	1.34 39	0.43 17	4.39 175	16.12 824	0.68 16	7.18 344	5.74 239	0.29 11	0.36 13	4.33 174	2.19 101	5.74 231	191.57 8184.40
Czech Republic	6.12 553	4.64 443	5.74 590	20.70 2200	2.96 300	2.55 276	10.33 1038	2.35 225	34.67 3568	0.46 34	1.19 66	3.12 321	11.55 1327	0.36 27	5.07 571	7.81 794	0.17 18	0.35 31	2.62 270	1.62 175	4.47 466	147.68 15125.00
Denmark	4.45 241	5.04 299	4.08 246	15.62 1015	4.09 235	1.06 64	7.95 481	1.22 73	29.51 1894	0.39 17	0.83 39	3.24 194	15.34 1170	0.33 11	4.98 346	4.08 242	0.13 9	0.26 17	2.90 176	2.28 152	4.00 273	129.90 8289.00
Estonia	7.71 77	5.99 60	13.65 149	19.90 235	5.93 66	1.85 21	10.16 110	2.55 27	44.16 506	1.66 8	2.06 14	2.55 33	21.63 292	0.39 3	6.00 74	7.89 92	0.22 3	0.44 4	5.68 59	2.12 26	5.20 60	183.77 2083.90
Finland	2.63 143	3.27 185	4.00 244	12.10 748	4.86 303	1.43 92	8.83 535	0.64 36	22.55 1381	0.26 11	0.92 43	2.81 171	11.88 859	0.52 15	2.47 168	3.83 236	0.36 21	0.23 13	3.82 253	2.17 140	3.23 198	105.45 648.00
France	5.07 2944	4.62 2961	4.05 2816	13.51 10291	7.46 4934	0.55 452	7.98 5417	1.43 916	35.99 22728	0.56 281	0.89 513	2.09 1486	9.08 8665	0.25 102	4.78 3980	4.87 3497	0.24 170	0.27 151	3.33 2511	2.02 1646	4.28 3215	135.70 9508.00
Germany	5.03 4086	4.82 4269	5.43 5429	13.86 14491	4.59 4491	1.54 1611	8.57 8497	1.43 1291	30.84 29378	0.39 255	0.96 734	2.21 2231	11.21 13900	0.27 145	3.36 3963	5.59 5954	0.31 300	0.22 180	3.35 3532	1.43 1519	4.44 4290	126.54 12654.60
Greece	2.24 250	1.34 158	6.48 842	12.01 1798	3.32 407	0.71 96	8.03 1011	2.45 322	46.98 5745	0.63 68	1.04 90	1.77 231	9.03 1763	0.39 23	6.92 1078	3.53 474	0.23 28	0.38 45	2.97 323	1.62 240	4.72 624	138.87 18495.70
Hungary	15.25 1167	5.74 464	9.70 853	31.84 2890	2.03 177	2.46 219	10.76 946	4.82 389	62.83 5356	0.47 27	1.74 99	3.70 319	12.54 1258	0.67 40	7.23 679	5.57 481	0.27 24	0.32 24	3.81 321	1.45 130	6.56 489	208.75 17936.63
Iceland	1.79 5	2.98 9	3.36 11	12.85 41	3.36 10	0.18 1	7.47 25	- 48	15.74 -	- 48	- -	2.20 5	14.21 56	- 12	3.38 19	6.26 3	0.79 1	0.40 11	3.25 7	1.60 15	5.48 311.00	95.66 311.00
Ireland	3.83 140	7.23 274	5.00 193	17.37 683	4.42 167	0.46 18	7.67 297	1.29 48	27.03 1043	0.47 17	0.83 27	3.47 133	11.84 527	0.10 3	3.87 170	4.01 156	0.39 13	0.43 14	3.95 159	2.25 93	3.66 141	124.36 4848.00
Italy	2.92 1899	1.93 1359	6.92 5491	14.02 11599	5.85 4270	1.80 1518	7.46 5555	1.75 1319	31.38 24405	0.63 273	0.82 486	2.23 1637	6.98 7214	0.26 99	4.77 4440	3.76 2968	0.29 219	0.48 254	3.52 2674	2.11 1757	4.83 3406	126.21 9959.15
Latvia	9.62 148	6.83 106	16.64 278	17.09 315	2.40 38	1.00 20	10.66 170	4.38 67	40.57 674	0.80 12	1.00 13	3.30 59	20.32 392	0.65 8	8.67 158	7.10 124	0.35 7	0.38 5	3.21 55	1.95 33	4.52 78	183.45 3094.00
Lithuania	11.15 236	7.65 172	16.21 414	19.55 527	3.82 89	1.39 35	9.46 227	5.48 122	45.90 1098	0.60 11	1.34 20	2.95 71	18.32 544	0.42 6	6.28 180	8.16 197	0.44 11	0.37 9	3.08 75	1.76 47	5.66 134	192.29 4721.00
Luxembourg	1.89 10	2.43 12	2.78 15	12.69 63	4.49 25	0.92 5	5.22 27	1.88 8	28.94 145	0.21 1	1.32 6	2.49 13	9.71 55	0.21 1	3.90 22	2.12 14	0.39 3	0.27 1	2.34 12	2.35 29	6.07 561	108.12 561.00
Macedonia	2.97 44	1.50 23	12.54 198	15.86 249	7.03 108	0.82 12	7.99 122	5.08 81	44.44 689	0.97 13	0.36 4	3.62 54	11.78 203	0.59 7	5.40 84	1.46 23	0.16 3	0.57 8	1.26 18	1.16 19	2.83 42	141.58 2198.00
Malta	4.11 17	2.74 12	3.06 17	14.51 70	3.55 15	1.01 5	11.82 50	1.09 5	31.42 148	0.87 2	1.01 3	1.00 4	7.88 39	0.54 2	4.00 19	3.32 15	0.13 1	0.36 1	4.01 20	1.51 7	2.26 10	111.58 512.00
Netherlands	2.62 430	7.65 1342	4.45 824	17.74 3344	2.51 433	0.96 177	7.59 1363	0.88 157	32.85 6141	0.62 72	1.06 148	3.08 516	12.11 2641	0.22 23	4.12 843	5.52 1002	0.17 30	0.23 38	3.50 647	2.52 482	4.23 751	133.39 24679.00
Norway	2.37 10	3.18 12	3.84 17	16.19 70	2.61 15	0.44 63	7.46 25	0.64 27	22.83 145	0.23 1	0.53 6	4.69 13	15.85 55	0.12 1	3.43 22	3.11 14	0.40 3	0.16 12	3.37 12	2.53 29	3.77 561.00	110.02 561.00

	Oral cavity/ Pharynx	Esophagus	Stomach	Intestines	Liver	Gallbladder	Pancreas	Larynx	Lung	Bone	Connective/soft tissue sarcomas	Skin	Prostate	Testis	Bladder	Kidney	Thyroid	HL	NHL	MM	Leukemias	All neoplasms
Poland	112 6.95	160 3.74	204 10.53	864 21.41	128 1.36	24 1.93	376 7.82	34 4.48	1191 50.21	11 0.74	23 0.94	224 4.31	1045 13.38	5 0.54	215 8.62	167 5.67	19 0.27	8 0.39	187 3.08	143 2.06	186 5.02	5962 178.85
Portugal	7.07 6.20	4.62 437	12.48 1403	20.31 2529	6.61 695	1.42 169	6.91 753	2.85 285	28.97 3041	0.60 45	0.71 65	237 241	1461 1723	129 15	2990 743	1847 303	91 40	105 31	956 455	689 291	1528 470	5831 143.69
Rep. of Moldova	11.74 263	2.90 65	13.81 302	22.21 483	1.34 29	0.70 16	8.79 195	6.39 146	35.48 776	1.22 23	1.04 16	2.81 60	9.56 213	0.48 10	5.80 127	3.98 82	0.43 9	0.77 16	3.12 60	0.56 12	4.05 81	16290 3569
Romania	12.17 1869	3.53 572	12.34 2230	19.49 3691	3.24 543	1.28 240	9.03 1578	5.93 963	47.80 8058	1.56 235	0.74 107	2.65 489	10.02 2198	0.46 61	6.12 1211	3.45 595	0.34 60	0.43 63	2.46 386	1.11 205	4.74 763	175.29 3043
Russia	8.33 7622	5.69 5242	19.38 17960	18.74 17476	5.48 4974	- -	8.81 8095	4.39 4022	44.71 41123	- -	1.76 1601	11.77 11111	- -	5.46 5144	- -	- -	- -	2.40 2092	1.09 968	4.53 3633	169.75 15500	
Serbia	6.22 404	3.17 212	7.90 587	21.92 1648	1.90 133	1.75 130	8.44 618	4.89 337	55.22 3815	0.93 62	1.19 56	4.27 301	12.11 1073	0.93 40	7.02 546	4.03 275	0.49 33	0.85 43	2.53 173	1.57 115	5.04 319	177.28 12666
Slovakia	13.75 554	6.11 251	8.94 371	28.39 1194	3.70 153	2.84 120	10.33 428	3.87 156	38.71 1607	0.71 25	1.12 41	3.96 161	16.75 738	0.67 23	6.54 283	7.00 282	0.27 11	0.59 23	4.59 188	2.24 94	5.18 202	186.29 7671
Slovenia	6.46 122	3.47 72	9.58 211	21.48 467	7.24 156	1.75 40	8.92 185	1.95 41	39.96 836	0.30 6	1.39 18	3.84 83	15.78 404	0.45 6	5.10 129	6.12 129	0.34 8	0.19 4	4.67 100	2.20 50	5.79 114	161.35 3475
Spain	4.04 1733	3.65 1626	6.35 3331	17.32 9552	6.50 3064	1.06 606	6.90 3311	2.58 1228	36.43 17259	0.70 194	0.78 309	1.70 931	8.25 5757	0.14 44	6.25 3860	4.67 2418	0.26 133	0.27 122	2.86 1467	1.66 976	4.04 2002	132.55 6784
Sweden	2.19 221	3.03 331	3.10 348	13.37 1611	2.37 253	1.72 193	7.60 872	0.42 48	15.48 1813	0.22 20	1.12 98	3.35 363	15.69 2357	0.10 7	3.55 477	3.37 387	0.26 30	0.15 17	2.83 341	2.09 264	3.49 393	101.95 1224
Switzerland	3.69 293	4.06 343	3.82 332	11.40 1072	5.62 484	0.86 78	7.03 605	0.81 65	23.97 2056	0.33 21	1.08 73	3.02 278	11.97 1356	0.33 19	3.82 403	3.22 307	0.37 33	0.25 22	2.78 274	2.23 217	3.70 345	107.68 9845
Ukraine	10.73 3111	4.74 1390	14.40 4389	17.92 5653	3.21 925	- -	7.88 2356	4.56 1331	34.07 10264	- -	- -	1.88 544	10.91 3644	- -	5.13 1644	- -	- -	- -	2.46 670	0.89 263	4.71 1207	149.05 4451
UK	3.26 1927	8.18 5466	3.84 2817	14.92 10880	4.19 2875	0.44 332	6.48 4469	1.04 698	26.88 19200	0.47 207	0.88 487	2.86 1962	13.25 11827	0.18 71	4.31 3681	4.05 2796	0.22 153	0.32 188	3.76 2718	2.22 1725	3.91 2734	124.35 8977
UK, England	3.13 1639	8.04 4793	3.79 2483	14.66 9559	4.02 2447	0.44 297	6.48 3988	0.95 574	25.97 16574	0.47 179	0.88 430	2.87 1746	13.17 10580	0.15 55	4.26 3265	3.97 2443	0.23 139	0.32 164	3.71 2406	2.17 1505	3.87 2429	122.05 7882
Wales	5.31 Ireland	7.46 84	4.04 121	16.03 72	4.79 287	0.39 87	6.43 116	1.45 24	30.64 551	0.64 8	0.98 15	3.31 60	12.08 262	0.48 5	4.22 87	4.78 89	0.09 3	0.32 6	4.32 77	2.66 52	5.52 78	134.76 2415
UK, Northern Ireland	3.97 204	9.90 552	4.35 262	17.38 1034	5.88 341	0.47 29	6.47 365	1.75 100	35.37 2075	0.49 20	0.89 42	2.67 156	14.40 985	0.32 11	4.88 329	4.69 264	0.18 11	0.33 18	4.13 235	2.60 168	3.79 227	145.15 8537
EU-28	5.03 22892	4.58 23128	6.28 34666	16.06 93241	4.80 25602	1.24 7263	7.91 42462	2.13 10667	34.83 183943	0.59 2197	0.91 3877	2.54 14009	10.71 74998	0.29 946	4.99 31938	4.72 26447	0.27 1478	0.32 1439	3.36 18802	1.89 11380	4.39 23713	137.55 760123

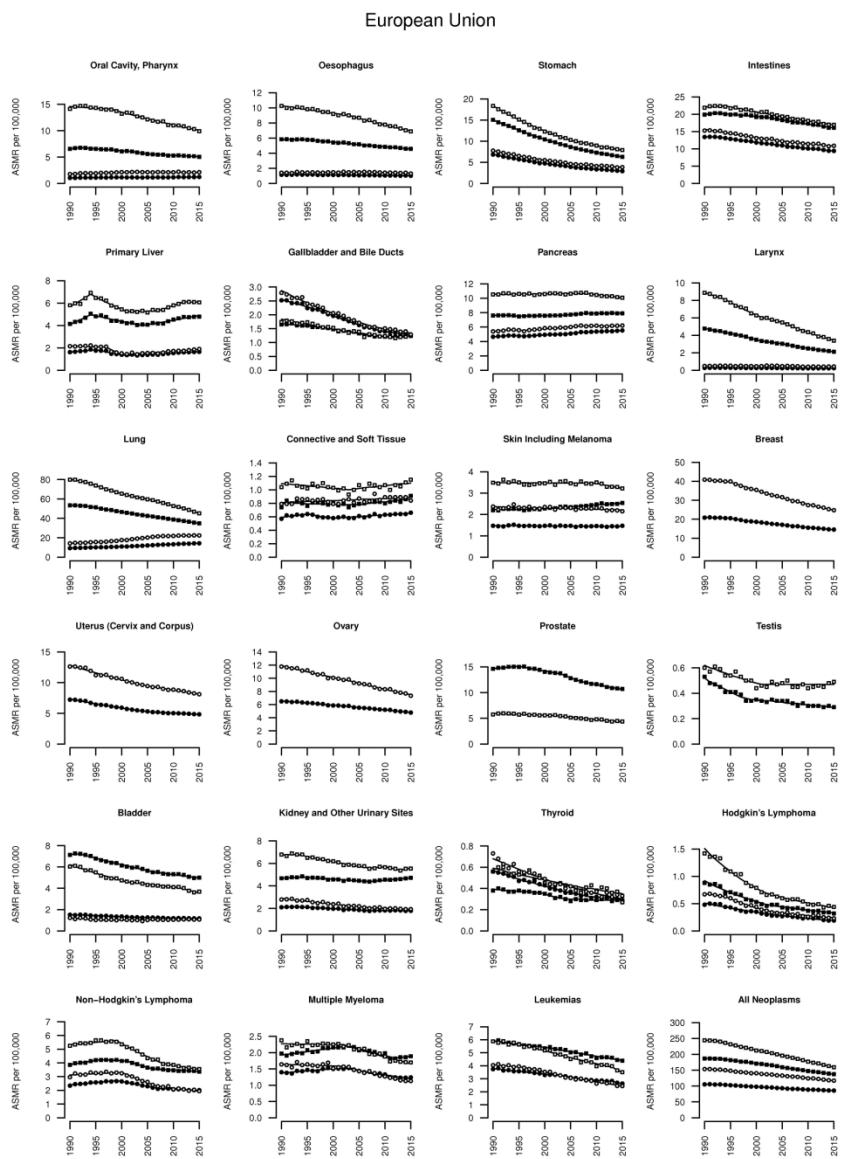
<sup>a</sup>Available year for Russia and Macedonia: 2013; for Belarus, Bulgaria and Slovakia: 2014.

**Table 2.** Overall age-standardized (world population) mortality rates (first row) and average annual number of deaths (second row) from selected cancers per 100,000 women in 36 European countries plus the European Union as a whole (EU-28) in 2015<sup>a</sup>.

	Oral cavity/ Pharynx	Esophagus	Stomach	Intestines	Liver	Gallbladder	Pancreas	Larynx	Lung	Bone	Connective/soft tissue sarcomas	Skin	Breast	Uterus	Ovary	Bladder	Kidney	Thyroid	HL	NHL	MM	Leukemias	All neoplasms
IC-D10	C00-C14	C15	C16	C17-C21, C26	C22.0- C22.7	C23- C24	C25	C32	C33- C34	C40- C41	C47,C49	C43- C44	C50	C53- C55	C56- C57.4	C67	C64- C66,C68	C73	C81	C82- C85,C 96	C88,C 90	C91-C95	C00-D48
Austria	1.40	0.66	2.74	6.78	2.08	1.02	6.18	0.21	15.04	0.26	0.83	1.62	13.81	3.83	4.18	0.90	1.69	0.23	0.15	1.92	1.31	2.52	81.76
	153	67	363	973	242	148	805	21	1493	14	61	201	1568	413	465	152	246	36	15	273	175	332	9755
Belarus	0.96	0.38	6.60	9.38	1.15	-	3.73	0.04	3.11	-	-	1.37	11.87	7.30	4.74	0.33	-	-	-	1.39	1.19	2.40	71.34
	88	40	719	1107	114	-	409	5	339	-	-	122	1106	647	422	49	-	-	-	152	123	253	7171
Belgium	1.29	1.38	1.59	8.56	1.75	0.46	5.42	0.18	15.68	0.35	0.67	1.48	15.25	3.59	4.62	1.20	1.53	0.30	0.13	1.94	1.22	2.91	83.45
	162	201	268	1541	270	95	895	26	1936	41	87	219	2167	524	669	252	253	46	18	374	229	507	12750
Bulgaria	1.22	0.36	4.46	10.08	1.24	0.90	5.16	0.38	8.86	0.63	0.09	1.15	16.11	9.78	5.27	1.40	1.05	0.26	0.62	1.54	0.62	1.93	87.02
	92	28	441	1095	124	94	520	32	739	43	11	119	1343	726	416	143	93	28	29	118	58	175	7575
Croatia	1.45	0.72	4.98	13.31	1.74	1.98	6.54	0.21	14.01	0.68	0.81	2.29	18.14	6.34	5.88	1.66	1.91	0.22	0.23	2.57	1.56	3.42	103.10
	68	40	323	889	96	142	399	12	720	32	17	152	1038	346	322	131	135	16	9	173	98	183	6122
Czech Republic	1.63	0.65	3.29	10.69	1.02	2.70	6.70	0.21	13.25	0.40	0.75	1.67	12.35	6.13	6.28	1.39	2.93	0.28	0.22	1.81	1.41	2.53	90.36
	190	83	450	1613	144	404	982	27	1693	26	65	245	1609	753	736	242	419	43	29	272	203	370	12311
Denmark	1.59	1.26	1.88	11.60	1.84	0.93	6.36	0.24	25.63	0.21	0.65	1.80	14.83	3.75	5.29	1.67	1.68	0.32	0.15	1.38	1.23	2.76	100.65
	99	97	131	935	130	62	480	14	1788	12	31	132	1069	259	368	144	133	26	12	125	111	221	7430
Estonia	0.94	0.52	6.24	11.20	1.69	1.57	5.46	0.10	9.02	0.77	2.14	1.83	13.74	7.19	5.58	0.97	2.87	0.91	0.15	2.16	2.13	2.98	90.65
	16	10	127	261	36	37	128	2	166	5	5	55	240	115	106	26	82	20	2	54	42	70	1826
Finland	0.95	1.10	2.10	7.58	2.04	1.40	6.53	0.06	10.27	0.17	0.80	1.18	11.86	3.23	5.64	0.69	1.87	0.34	0.10	2.84	1.57	2.02	72.54
	74	89	169	663	186	139	545	4	771	13	34	100	813	247	411	74	171	34	10	263	139	166	5798
France	1.18	0.95	1.54	7.97	1.84	0.51	5.26	0.23	12.34	0.33	0.60	1.19	14.54	3.96	4.00	0.93	1.60	0.20	0.12	1.80	1.25	2.44	76.03
	909	865	1536	9074	1793	625	5339	156	9055	226	461	1130	12233	3395	3458	1202	1683	232	95	2072	1494	2625	71313
Germany	1.29	1.00	2.77	8.33	1.74	1.39	6.26	0.21	15.18	0.23	0.74	1.32	15.45	3.71	4.69	1.08	2.28	0.28	0.12	1.91	0.93	2.65	85.01
	1378	1238	3829	12572	2126	2090	8659	205	15881	168	690	1637	18136	4143	5573	1872	3362	416	132	2915	1280	3579	107396
Greece	0.70	0.21	2.94	7.02	1.15	0.42	4.91	0.18	10.35	0.37	0.69	1.08	13.60	3.55	4.21	0.97	1.08	0.29	0.29	1.32	1.25	2.99	72.63
	121	29	515	1402	178	81	848	29	1413	49	75	173	2117	499	562	228	199	52	46	218	246	513	11833
Hungary	2.91	0.90	4.55	15.08	0.67	2.39	7.28	0.74	29.42	0.25	1.20	1.55	17.88	8.02	6.13	1.88	2.04	0.35	0.26	2.20	1.24	4.21	122.80
	305	113	647	2229	82	365	1032	74	3397	12	79	225	2220	883	728	280	294	55	22	285	167	470	15443
Iceland	0.39	0.97	2.60	9.87	2.43	1.15	7.05	-	22.08	-	1.04	0.51	18.07	2.69	4.41	0.73	1.05	0.29	0.15	2.21	0.53	1.30	89.16
	2	5	12	32	9	5	28	-	69	-	3	2	55	7	15	3	6	2	1	6	3	4	299
Ireland	0.97	2.62	2.66	9.59	2.07	0.79	5.25	0.21	17.80	0.25	0.39	1.60	16.67	5.94	6.49	1.35	1.74	0.39	0.24	2.61	1.62	2.21	94.23
	46	132	135	471	90	43	250	9	785	8	18	90	678	231	267	71	89	19	11	127	82	105	4241
Italy	1.03	0.48	3.52	8.97	1.88	1.49	5.49	0.17	10.71	0.36	0.60	1.24	14.12	3.55	3.94	0.88	1.37	0.29	0.25	2.11	1.46	2.73	80.02
	990	485	3933	10450	2043	1777	5945	161	9570	200	407	1197	12312	2969	3269	1214	1470	331	170	2234	1688	2629	79500
Latvia	1.39	0.88	6.43	11.22	1.15	0.84	5.69	0.04	7.68	0.50	0.78	2.54	17.02	11.39	8.35	1.44	2.85	0.62	0.25	1.96	1.57	3.96	100.51
	36	21	194	405	36	31	202	3	217	8	17	70	445	261	212	61	102	21	5	63	41	97	2901
Lithuania	1.80	0.78	6.51	10.08	1.28	1.43	5.10	0.37	5.79	0.62	0.66	1.57	15.92	10.46	7.57	0.79	2.57	0.35	0.33	1.73	1.30	3.10	92.64
	60	31	269	494	59	61	243	10	246	16	23	77	571	359	282	53	123	22	8	94	61	115	3784
Luxembourg	1.62	1.12	2.31	8.50	1.17	0.78	4.69	-	12.42	-	1.61	0.58	17.08	3.94	5.04	0.91	1.71	0.21	-	1.84	1.28	2.23	78.10
	7	7	16	65	9	5	34	-	79	-	9	4	93	22	35	8	11	3	-	18	9	16	519
Macedonia	0.80	0.37	5.72	10.20	4.23	0.88	4.41	0.50	9.34	0.52	0.33	2.34	16.04	7.78	4.26	1.46	1.48	0.63	0.40	0.94	0.54	2.81	84.34
	14	7	109	190	70	18	85	9	159	10	5	43	272	125	73	28	17	12	6	18	10	42	1459
Malta	1.57	0.87	2.87	8.31	0.84	1.36	5.57	0.47	8.08	-	0.48	0.37	15.12	3.86	7.36	1.15	2.23	0.72	0.38	2.39	0.93	2.28	76.26
	8	5	17	56	6	9	33	2	41	-	3	4	81	20	36	7	11	3	2	13	6	12	427
Netherlands	1.03	2.15	2.12	12.33	1.17	1.05	6.11	0.22	22.70	0.36	0.67	2.08	16.79	3.28	4.90	1.33	2.36	0.23	0.18	2.20	1.51	2.68	99.41
	224	471	466	2974	233	253	1331	46	4279	52	117	411	3271	668	1013	333	530	61	32	545	380	565	21066
Norway	0.82	0.84	1.75	11.80	1.30	0.79	5.70	0.17	17.31	0.20	0.67	2.65	10.32	3.82	5.70	1.01	1.35	0.39	0.09	2.04	1.91	1.90	80.90

	Oral cavity/ Pharynx	Esophagus	Stomach	Intestines	Liver	Gallbladder	Pancreas	Larynx	Lung	Bone	Connective/soft tissue sarcomas	Skin	Breast	Uterus	Ovary	Bladder	Kidney	Thyroid	HL	NHL	MM	Leukemias	All neoplasms
Poland	54 1.56	56 0.72	121 3.85	839 11.15	81 0.64	55 2.47	385 5.03	10 0.50	984 17.96	8 0.34	33 0.69	155 2.34	585 14.75	218 7.92	299 7.02	82 1.46	99 2.22	29 0.37	6 0.20	140 2.06	134 1.36	127 2.80	5098 103.31
Portugal	676 0.73	316 0.43	1860 5.72	5812 9.57	290 1.40	1214 0.92	2440 3.89	205 0.15	7484 7.23	125 0.57	233 0.53	1408 1.12	6319 12.46	3443 4.28	2785 2.58	815 1.13	1068 0.70	201 0.35	73 0.19	915 2.34	681 1.23	1264 2.65	47281 70.77
Rep. of Moldova	107 1.11	79 0.34	937 5.20	1717 11.45	229 0.68	165 0.71	670 4.86	18 0.15	982 5.83	62 1.17	64 0.38	204 1.54	1690 17.49	607 9.15	351 4.50	268 1.01	136 1.38	68 0.56	22 0.48	392 2.41	236 0.50	404 2.59	10981 86.65
Romania	1.43 305	0.54 128	4.37 1125	9.88 2613	1.33 324	1.12 276	5.06 1286	0.27 58	10.35 2303	0.79 155	0.48 95	1.87 445	15.67 3433	11.92 2274	5.11 1071	1.08 342	1.31 345	0.36 100	0.19 33	1.66 330	0.83 191	3.33 566	93.52 21048
Russia	1.23 1823	0.74 1320	7.90 13509	12.10 21276	2.33 3951	- -	4.69 8022	0.17 248	5.57 8945	- -	- -	1.32 1855	15.68 22890	9.65 13170	5.50 7713	0.71 1417	- -	- -	- -	1.32 1903	0.82 1237	2.87 3499	89.09 136773
Serbia	1.20 97	0.72 59	3.51 316	10.85 1039	0.81 73	1.83 182	5.61 516	0.46 41	18.24 1449	0.50 33	0.41 30	2.03 200	20.17 1693	9.77 741	6.07 459	1.51 160	2.02 173	0.38 33	0.48 29	1.81 157	0.98 91	2.76 216	9233 5982
Slovakia	1.65 89	0.66 37	4.61 285	14.05 917	1.32 74	3.49 230	6.34 394	0.19 10	10.10 567	0.59 25	0.77 31	2.39 149	15.49 898	8.65 469	6.15 329	1.25 91	2.88 191	0.45 30	0.40 16	3.10 195	1.67 104	3.32 198	100.65 2738
Slovenia	0.84 24	0.59 14	3.94 128	10.50 350	2.81 93	1.68 51	5.78 182	0.36 9	14.24 356	0.37 6	0.71 18	2.88 76	15.54 428	5.69 162	6.51 156	1.19 50	1.74 57	0.14 9	0.27 5	3.34 133	1.84 60	2.32 78	93.51 2738
Spain	0.93 592	0.50 305	3.04 2175	8.67 6692	1.82 1348	0.90 744	4.47 3095	0.19 86	8.73 4366	0.30 136	0.60 281	1.11 759	10.85 6235	3.83 2269	3.67 1979	1.04 939	1.25 906	0.27 205	0.17 99	1.69 1233	1.15 928	2.58 1589	67.57 43705
Sweden	0.87 117	0.81 113	1.68 219	9.70 1474	1.20 156	2.13 300	6.66 940	0.04 7	14.44 1813	0.15 14	0.76 79	1.86 222	11.78 1423	4.28 522	4.50 553	1.03 197	1.79 262	0.26 44	0.08 16	1.82 307	1.56 242	2.26 353	82.32 11226
Switzerland	1.20 121	1.01 112	1.67 198	7.15 883	1.96 200	0.76 91	5.56 668	0.12 13	12.39 1186	0.29 21	0.86 76	1.73 186	13.51 1424	2.80 299	4.43 460	1.13 154	1.23 155	0.26 35	0.12 9	1.97 261	1.49 194	2.36 263	72.13 7977
Ukraine	0.91 428	0.37 173	5.46 2707	9.87 5268	1.32 655	- 1920	3.60 41	0.09 2109	4.24 -	- -	- 1.38	15.37 6832	9.50 3937	5.23 3937	0.51 2170	- 291	- -	- 548	- 316	1.29 1025	0.70 35012		
UK	1.21 913	2.66 2494	1.72 1581	9.98 9375	2.16 1930	0.64 588	5.11 4472	0.23 175	19.86 16357	0.29 138	0.70 411	1.58 1264	15.15 11470	4.22 3102	5.25 4067	1.59 1708	1.96 1677	0.28 254	0.22 152	2.43 2243	1.35 1360	2.27 1940	93.81 78972
UK, England	1.16 779	2.59 2172	1.62 1341	9.86 8224	2.09 1662	0.62 513	5.13 3976	0.22 144	19.05 13946	0.30 126	0.72 369	1.59 1130	15.12 10190	4.10 2682	5.23 3587	1.54 1482	1.90 1453	0.29 230	0.21 129	2.39 1974	1.34 1206	2.27 1714	92.31 69050
Wales	1.50 27	2.50 58	2.87 60	10.48 246	2.49 57	0.50 15	4.92 112	0.20 4	21.79 439	- 9	0.49 34	1.60 291	15.59 74	4.01 117	5.62 33	1.09 45	1.90 5	0.23 5	0.24 63	2.61 41	1.30 61	2.63 2062	
UK, Northern Ireland	1.59 107	3.33 264	2.35 180	11.06 905	2.73 211	0.87 60	4.93 384	0.40 27	27.44 1972	0.23 12	0.64 33	1.46 100	15.36 989	5.51 346	5.28 363	2.21 193	2.60 179	0.24 19	0.28 18	2.72 206	1.39 113	2.14 165	108.12 7860
UK, Scotland	1.23 7785	1.02 7474	2.91 22162	9.40 77122	1.65 12329	1.24 10023	5.53 42201	0.24 1402	88502 1580	0.34 3430	0.66 10764	1.47 93903	14.54 29691	4.84 30213	4.78 10900	1.17 14039	1.79 2370	0.29 1075	0.19 15945	2.01 10294	1.24 19137	2.63 603984	

<sup>a</sup>Available year for Russia and Macedonia: 2013; for Belarus, Bulgaria and Slovakia: 2014.



**Figure 1.** Joinpoint analysis of trends in age-standardized (world population) mortality rates from 23 cancer sites and all neoplasms (malignant and benign) in the European Union, from 1990 to 2015. Filled boxes represent men, all ages; empty boxes men, 35-64 age group; filled circles women, all ages; empty circles women, 35-64 age group.

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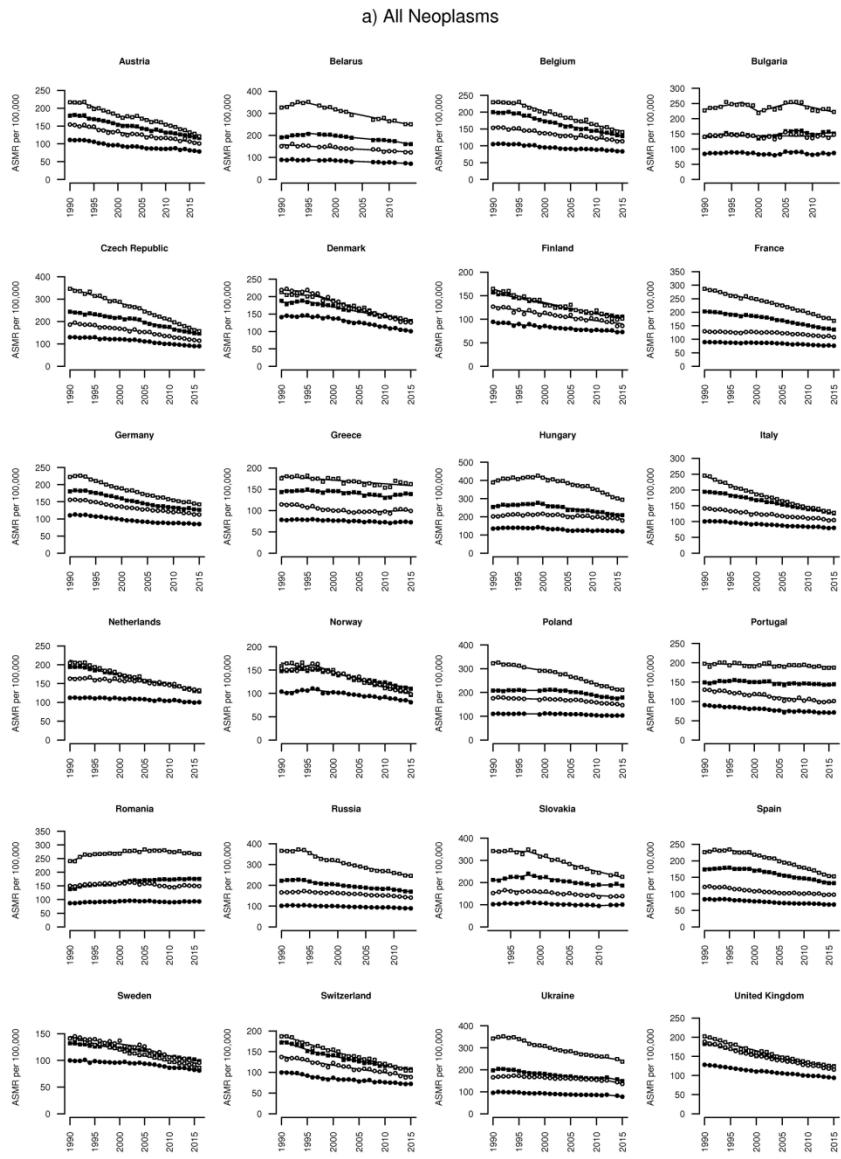


Figure 2. Joinpoint analysis of trends in age-standardized (world population) mortality rates from all neoplasms (a), cancers of intestines (b), lung (c), breast (d) and prostate (e), in 24 selected European countries, from 1990 to 2017 (according to data availability). Filled boxes represent men, all ages; empty boxes men, 35-64 age group; filled circles women, all ages; empty circles women, 35-64 age group.

215x279mm (300 x 300 DPI)

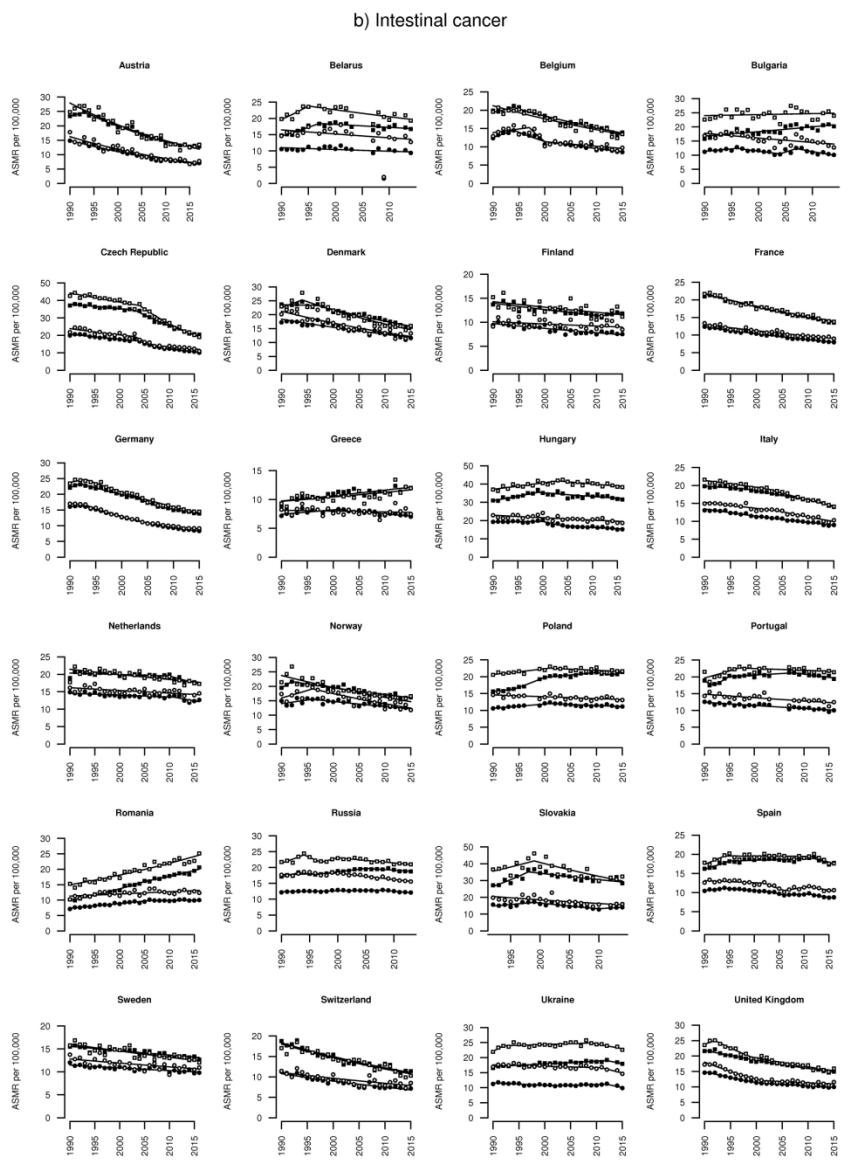


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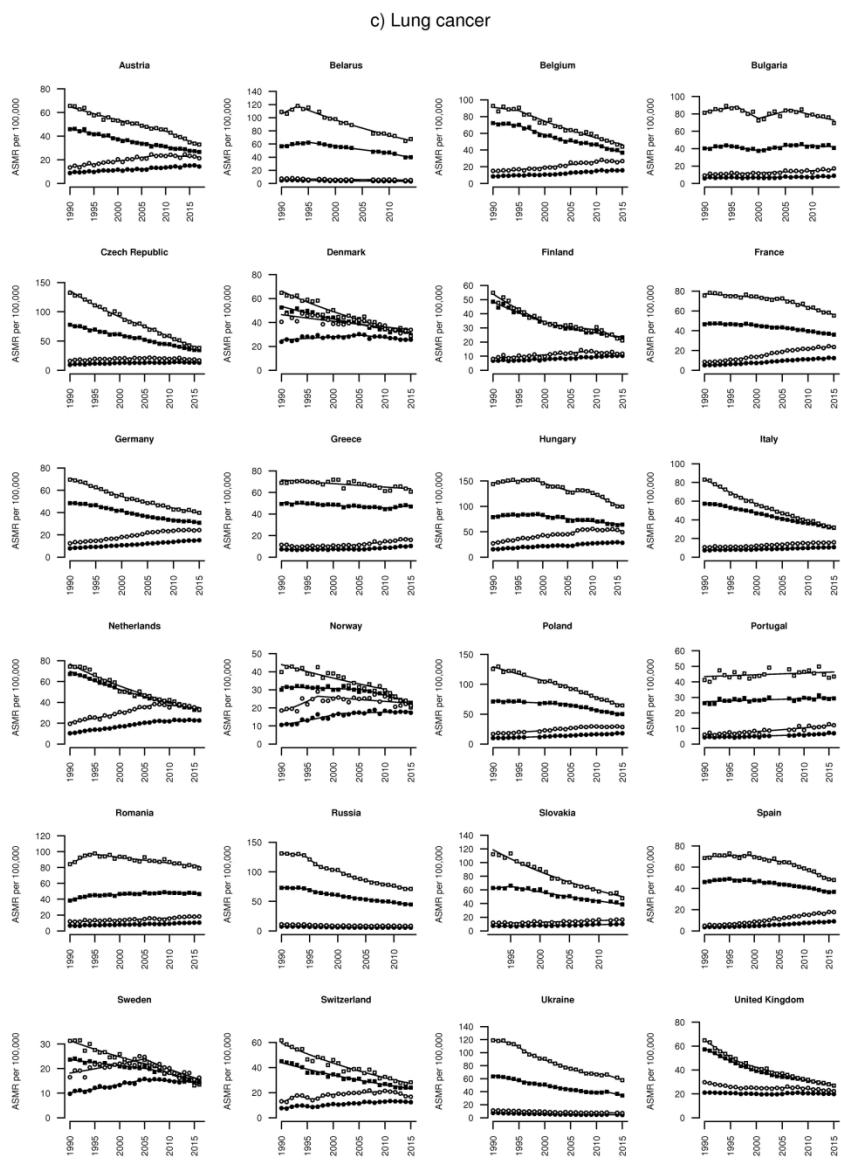


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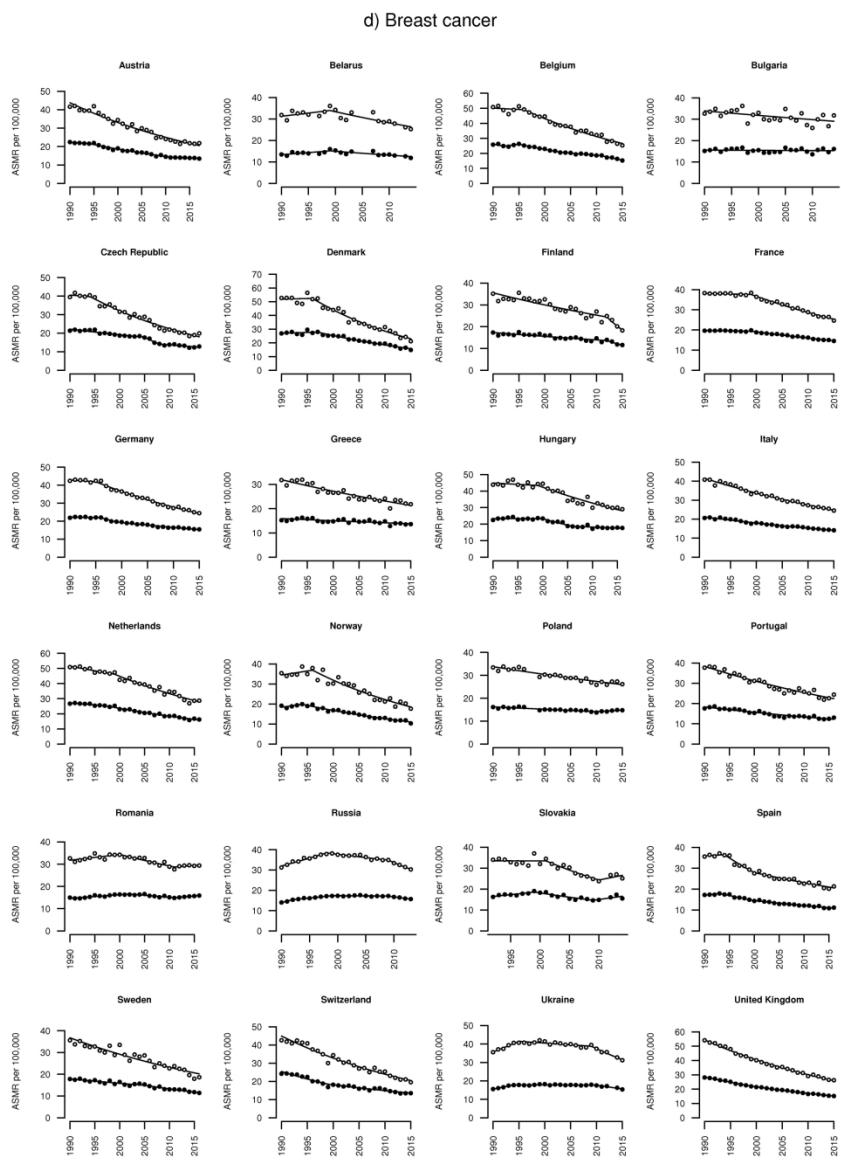


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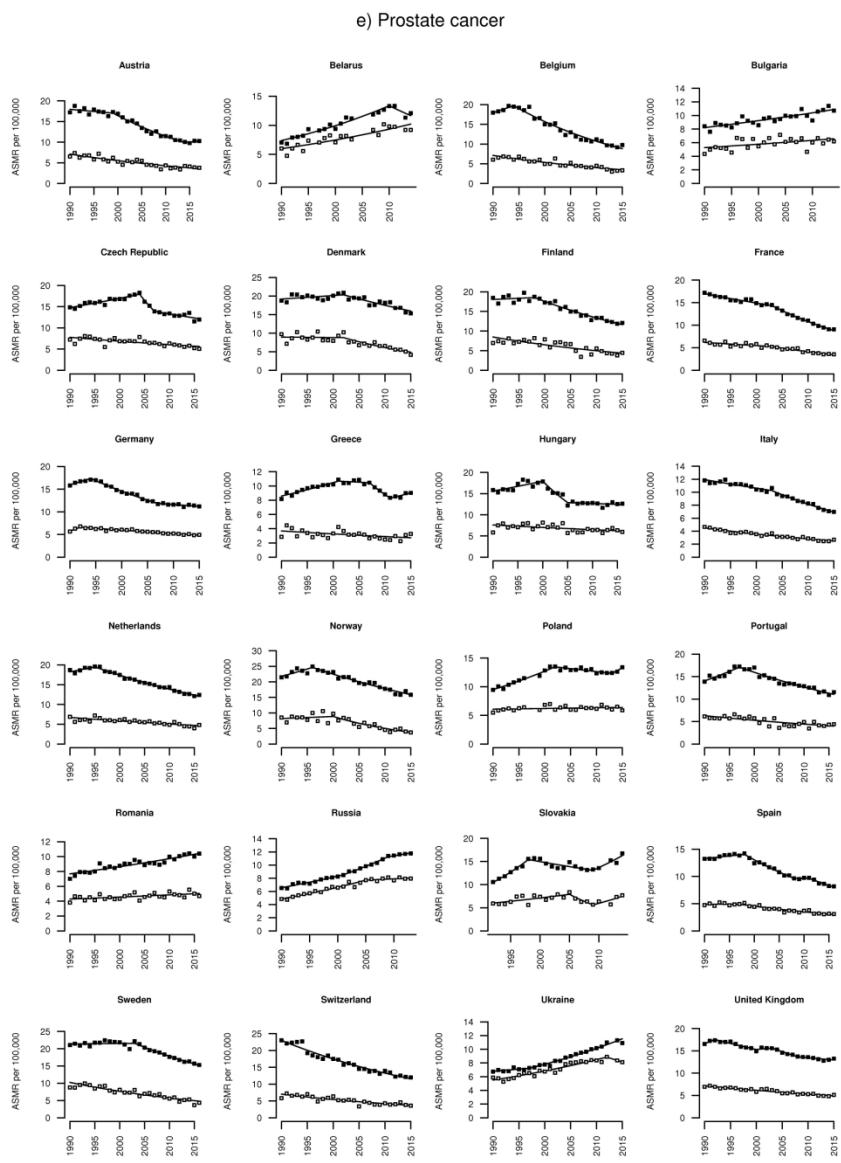


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